ISN Millennium™

LINC HARDWARE REFERENCE MANUAL REV 7

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Overview

The **LINC** is a single board communications device providing a means of transferring data from an RS 232 device onto the LAN.

The hardware platform has been designed to support five versions of software.

The LINC operates the hardware platform in one of the five variants, one at a time. The User must ensure that the correct version of software has been installed.

The Following Available Variants

- LINC CENTRAL
- LINC PRINTER
- LINC MODEM
- LINC TERMINAL
- LINC MONITOR

Communications Port

The Linc has been designed with two communication ports that benefits from three sets of hardware drivers. Port 2 may either use the RS 232 driver receivers, or use the RS 485 arrangement.

Each of the controllers has two communication ports:

- **Port 1** This is used for ISN LAN communications (communications adhere to the standard RS 485 protocol).
- **Port 2** This is configurable for use as either a general purpose RS 232 interface or the RS 485 network.

User Interface

Access to the software is also possible through either of the communication ports via a controller.

Primary Power Source

The Power Supply Requires:

- **115 Volts AC to 24 Volts** AC (+/– 10%) 50/60 Hz
- **1 A** source

Controller Supervision Circuit

A watchdog circuit is used to monitor the operation of the LINC. A visual indication of a system failure is provided by the status LED which is extinguished during a failure. There is one mode of watchdog operation; that is Auto Restart.

Enclosure Sizes

- ISN LINC W =**16"** x H = **7.5**" x D = **4.25"**

Agencies

The LINC has been designed to comply with the requirements of U.L.Safety Standard 916, FCC Part 15, Sub part B, and Class A requirements.

Board Dimensions

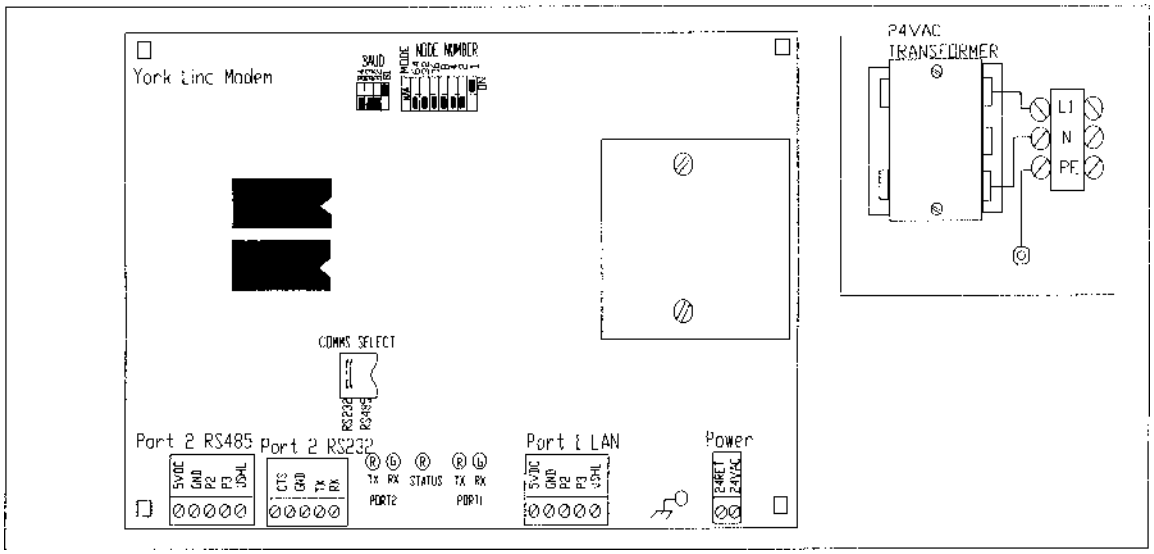
The dimensions of the Card Making Up a LINC Controller is shown below:

Dimensions LINC: (W = **7"** x H = **4"** x D = **2½**")

Main Components

The **ISN LINC** consists of one card only and is housed in a metal enclosure.

LINC Panel Layout



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The main power supply is included in the Linc enclosure.

The **ISN LINC** physically consists of one functional board. The primary component is:

- **LINC** (Local Interface Network Card)

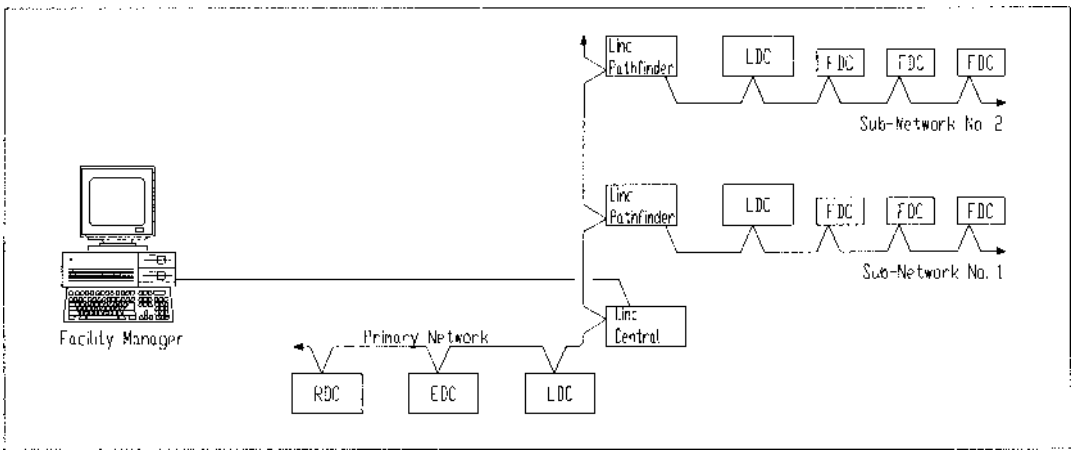
This board possesses no physical input and output capability.

LINC (Local Interface Network Card)

The **LINC** is a stand-alone device which has been designed to perform as a general purpose communications controller. From a hardware perspective, the LINC is a single board device. Its main function is to provide an interface between RS-232 devices and the York RS-485 network (LAN).

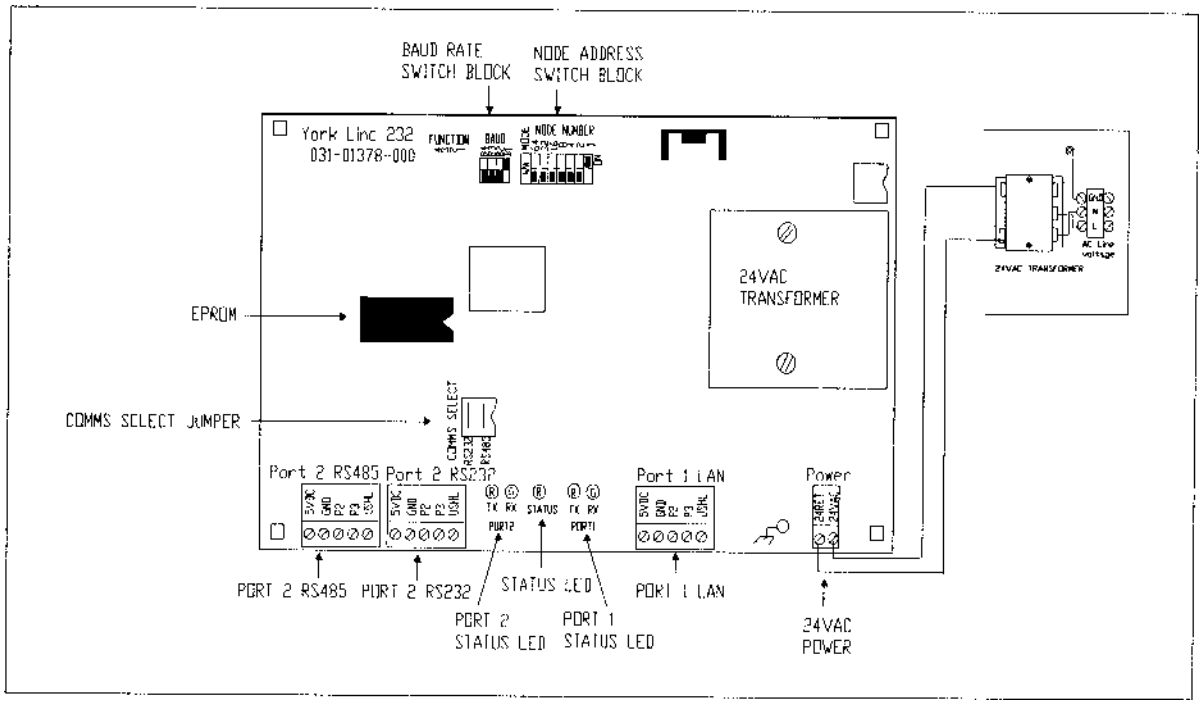
Typical System Interconnection

The ISN LINC controller is interconnected to the network through twisted shielded pair cable and plug in terminals on the RS-232 and RS-485 ports. The connection topology is shown in the diagram below.



Typical Linc Shown on the LAN

Diagram showing main features within the LINC Controller



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Main Features in the Linc Controller

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Environmental

The **LINC** is designed to operate in an environment specified below:

- Operating Temperature **32°F to 122°**F **0°C to 50°**C
- Operating Humidity **0% to 95%** non-condensing

The LINC's enclosure has been designed to withstand the normal dust associated with an equipment room without the need for additional enclosures or filtering. It should, however, **NOT** be installed in any hazardous environments.

Temperature Note

While the controller may appear to function satisfactorily at temperatures higher than those specified above, its operational longevity will be greatly impaired. Any failures associated with operation outside the above specification will automatically void the warranty.

Humidity Note

When working on a LINC in low humidity environment, special attention must be given to adhering to all anti-static precautions.

If confronted with this situation, an anti-static strap should be used by the User. If this is not available, then at the very least before attempting to touch the controller's circuit boards, the User must discharge himself or herself by making contact with a solid ground connection.

The humidity of the environment plays an important role in determining the long term reliability of the product. Very low humidity allows an electrostatic charge to build up in the surrounding air which, if not dealt with correctly, can result in the discharge of high voltage energies through the controller, consequently damaging the electronics or in the very best case causing a glitch in operations.

On the other hand, high humidity has the effect of decreasing the insulation resistance between the different nodes on the circuit board. This can also result in the malfunction of the unit, either temporarily or permanently.

Maintaining the environment within the correct specification will go a long way in ensuring reliability and service free operation of the unit.

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Protection

General

When planning the installation, consideration should be given to the routing of all of the cables. The following point should also be kept in mind.

When connecting controllers together that are located in different buildings, the use of fiber optic cable is highly recommended.

Fiber optic technology transfers data using a modulated light signal, which is not susceptible to electromagnetic interference and so benefits from improved operational performance. (For further details see York's networking reference manual).

Electrical Noise

As with all electronic equipment, the ISN LINC Controller may be detrimentally affected by the effects of external electrical noise. This noise may take the form of Radio Frequency Interference (**RFI**) or Electro-Magnetic Interference (**EMI**).

To minimize the effects of electrical noise in the first place, chose the installation location with providence.

Integrity of the Application's Program

Upon a power failure, the PROM will retain its memory and will reload upon power returning.

Precautions

To minimize the chances of the LINC suffering from the effects of electrical noise the following precautions should be adhered to.

1. Never site the unit within close proximity to high voltage power lines, generators or any other high power dissipating devices. (As a guide, a minimum of 30 feet should be maintained between the unit and any such power devices).

2. When the unit is operational and no maintenance is being rendered, always ensure the enclosure is kept fully closed.

3. The use of transmitting devices should not be encouraged within close proximity of the unit. If they are to be used, the unit's door should be closed.

4. When running communication wiring using screened cables, **ALWAYS** ensure that the screens of these cables are terminated correctly.

5. **ALWAYS** ensure that the controller has been connected to **a good solid building ground**. Failure to do this will not allow the protection devices to operate correctly and so will expose the electronics to the effects of electrical noise.

Communication Protection

Both **Port 1** and **Port 2** are surge protected by four fast acting transzorbs configured to clamp both positive and negative voltage spikes.

Building Ground Requirements

All ISN controllers have been designed to use building ground as a reference point. This electrical configuration helps to maintain all of the electronic components used by the controller to control within their specified common mode operating voltage limits. This is particularly important when connecting controllers together via the RS 485 LAN port or interfacing transducers to the input circuitry.

WARNING

In order to ensure the **LINC** operates in a reliable and predictable fashion, the User **MUST** connect the controller to a true building ground. Failure to do so could void any future warranty claims.

Electrical grounding, as well as being important to the correct operation of the controller, also protects it from the effects of lightning strikes. Experience throughout the country has shown inadequate or non-existent electrical system grounds to be the cause of most lightning related failures.

Many local municipalities do not follow the National Electrical code and often allow substandard electrical grounds to be installed. An example of a substandard ground would be a galvanized steel cold water pipe. As the pipe corrodes it will no longer act as a true ground. The corrosion acting as an insulator raises the potential of the pipe with respect to earth ground.

When lightning strikes in the near vicinity of an ISN installation, it alters the potential of the building's earth. If the ISN controller has been properly grounded, it will respond to this change much faster than if the ground connection is inadequate. Controllers that are poorly grounded provide a lower resistance path through their signal or power connections than the actual ground of the building. Under these circumstances large surge currents may flow through the controller and result in component failure. The most common circuits to be damaged are communication components like the RS 485 and RS 232 drivers, other components which are susceptible and related to the I/O interface circuitry.

Inspecting the Ground

York strongly recommends that the building's ground is checked prior to the start of the installation. This simple procedure may prevent expensive repairs being required in the future.

The power distribution panel should be checked to ensure that it is **NOT** connected to a corroded or galvanized pipe and that it **IS** connected with wire which is at a minimum (**14 AWG**).

The installer must also check to ensure that the LINC's cabinet and all of the electronics are connected to the power distribution's ground connection using a suitably sized copper conductor.

Mounting Instructions

The ISN LINC is intended to be installed in a building environment where it is protected from the direct influence of the elements. The unit should be prevented from being exposed to any corrosive chemicals and gases which may deface the enclosure, and / or damage the internal electronics. If the unit is to be installed outside the environment as described above, then you must contact **York Headquarters**.

All the equipment associated with the LINC must be fixed to a framework which is solid and not susceptible to oscillatory vibration. If the base is subjected to vibrations, then a shock absorbing material must be superimposed between the LINC's enclosure and the fixing framework. The enclosure should be mounted so that it does not impede access to other equipment, doorways or thoroughfares.

When choosing a location to mount the LINC, consideration should be given to the position of the nearest primary power outlet.

Once a suitable location has been identified for the LINC controller to be mounted, the next task is to physically attach it there. The following sequence may help in this procedure:

1. Using the dimensions provided in this manual, mark and drill two holes which correspond to the two eyelets located at the top of the enclosure.

2. Install two suitably sized screws into the drilled holes, and then fit the LDC's enclosure over these screws lowering the enclosure until the screws engage the eyelets.

3. With the enclosure hanging on the top two screws, mark the location of the bottom two holes.

4. Temporarily remove the enclosure from the top two screws, and drill two new holes corresponding to the bottom two marks.

5. Now replace the enclosure onto the top two screws, lowering it until the two holes on the fixing surface match the two holes in the enclosure. Fit the bottom two screws and tighten all four.

Summary of the Mounting Recommendations

ALWAYS: Mount the LINC controller inside the confines of a building.

NEVER: Mount the LINC controller under or beside pipes carrying water or chemicals.

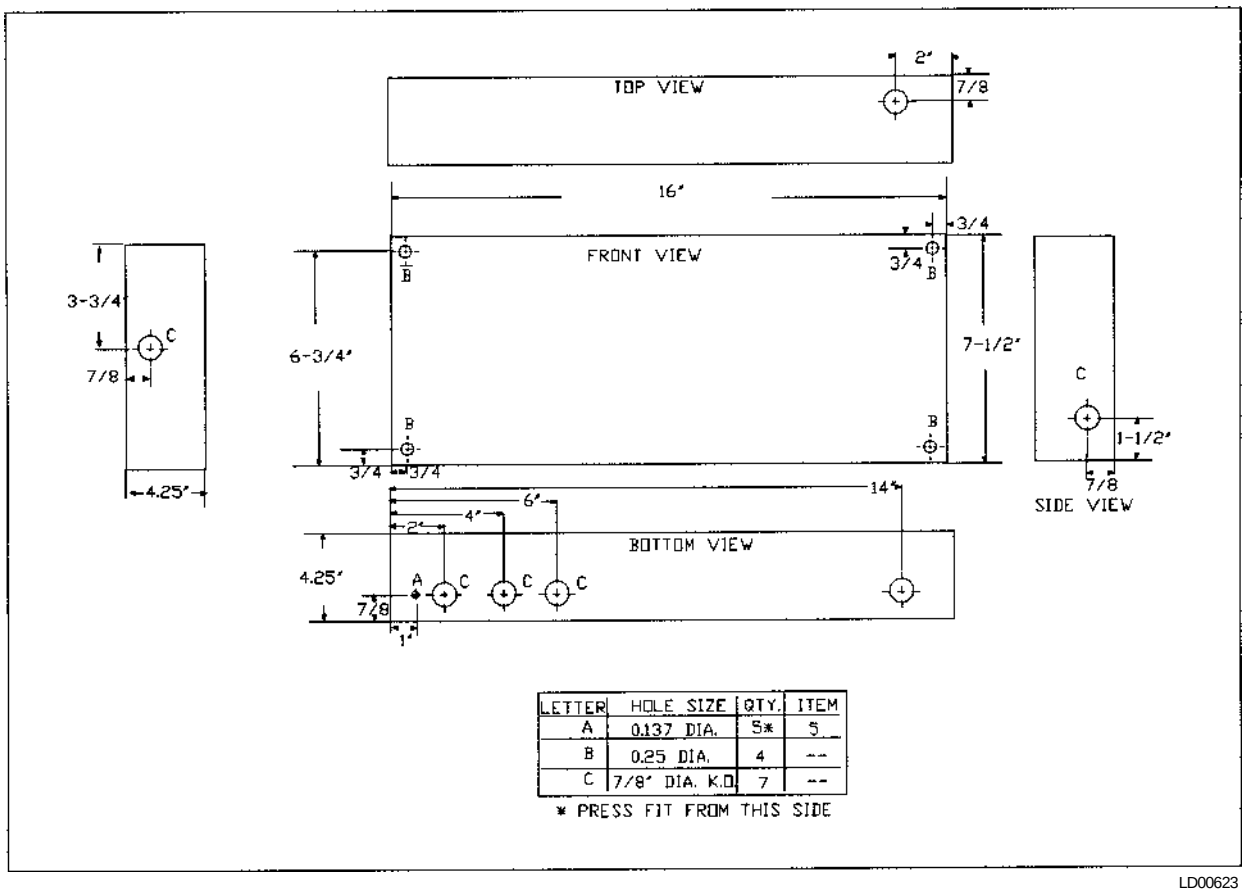
NEVER: Mount the LINC controller near high voltage cables, high voltage transformers / breakers, or close to high frequency drives.

NEVER: Mount the LINC controller outside the confines of a building.

NEVER: Mount the LINC controller in a location where the environment could be outside the specified operating specification.

NEVER: Mount the LINC controller on a vibrating surface without first employing some form of mechanical dampening.

Mounting Details for the LINC



LETTER	HOLE SIZE	QTY.	ITEM
A	0.137 DIA.	5*	5
B	0.25 DIA.	4	--
C	7/8" DIA. K.O.	7	--

* PRESS FIT FROM THIS SIDE

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All Dimensions are in inches

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Power Connections

Electrical Power Specification

The following is applicable for the ISN LINC controller and all associated equipment. A clean fused AC supply must be provided which conforms to:

- **115 VAC - (+/–10 %)**
- **50/60 Hz**

If the supply is exceptionally noisy (for example, is on the same power feed as a variable speed drive) and is not already filtered, then a filtered mains supply will be required.

If the incoming main power supply is susceptible to voltage ‘sags’ or spikes, a CVT (Constant Voltage Transformer) can help to smooth out the variations and so provide a more constant supply.

The LINC should be wired to a non-switched fused spur. This will prevent the power from being turned OFF accidentally.

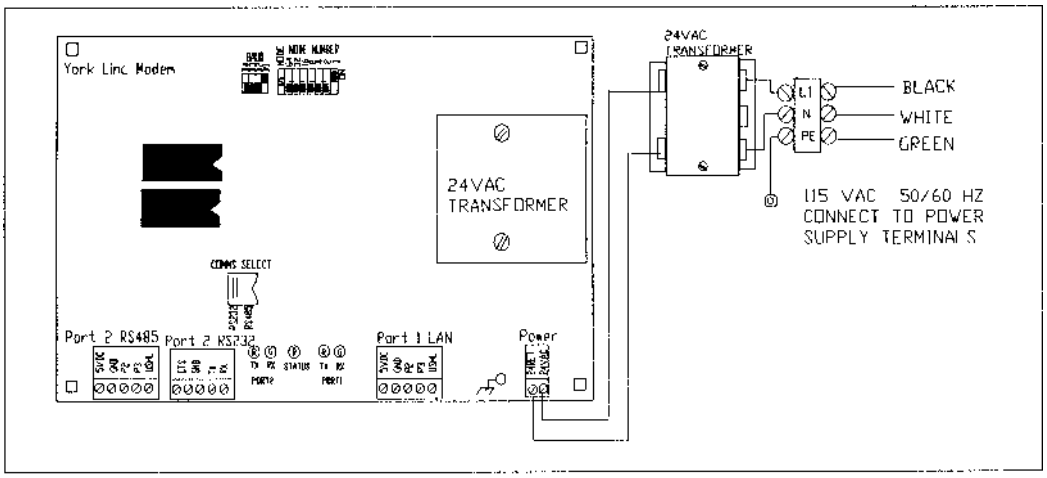
The LINC and all associated equipment should not be installed more than three feet from the main power spur. The supply spur should either be protected with a suitable fuse or an approved electronic power breaker.

The fuse or breaker protecting the LINC should be rated at **10 A.**

Note: While the ISN LINC has been designed to comply with FCC regulations, it is the responsibility of the installer to ensure the equipment does not interfere with other devices through RFI or conducted noise. This is best ensured by strictly following the recommendations given in this manual.

The primary power input for the LINC is always provided by a **115 VAC** source.

Power details showing a LINC



Connect 115VAC supply to the main power terminals.

WARNING

Make sure the **two 24VAC** power wires have been connected correctly; otherwise, the controller could malfunction.

1. With the power at the feeding spur being disabled, connect the **24 VAC** to the supply of the **24 VAC transformer.**

2. Connect the **24 RET** to the **24 RETURN of the 24 VAC transformer.**

3. Check to ensure that no wires are touching any adjacent circuits.

4. Enable the power at the feeding spur.

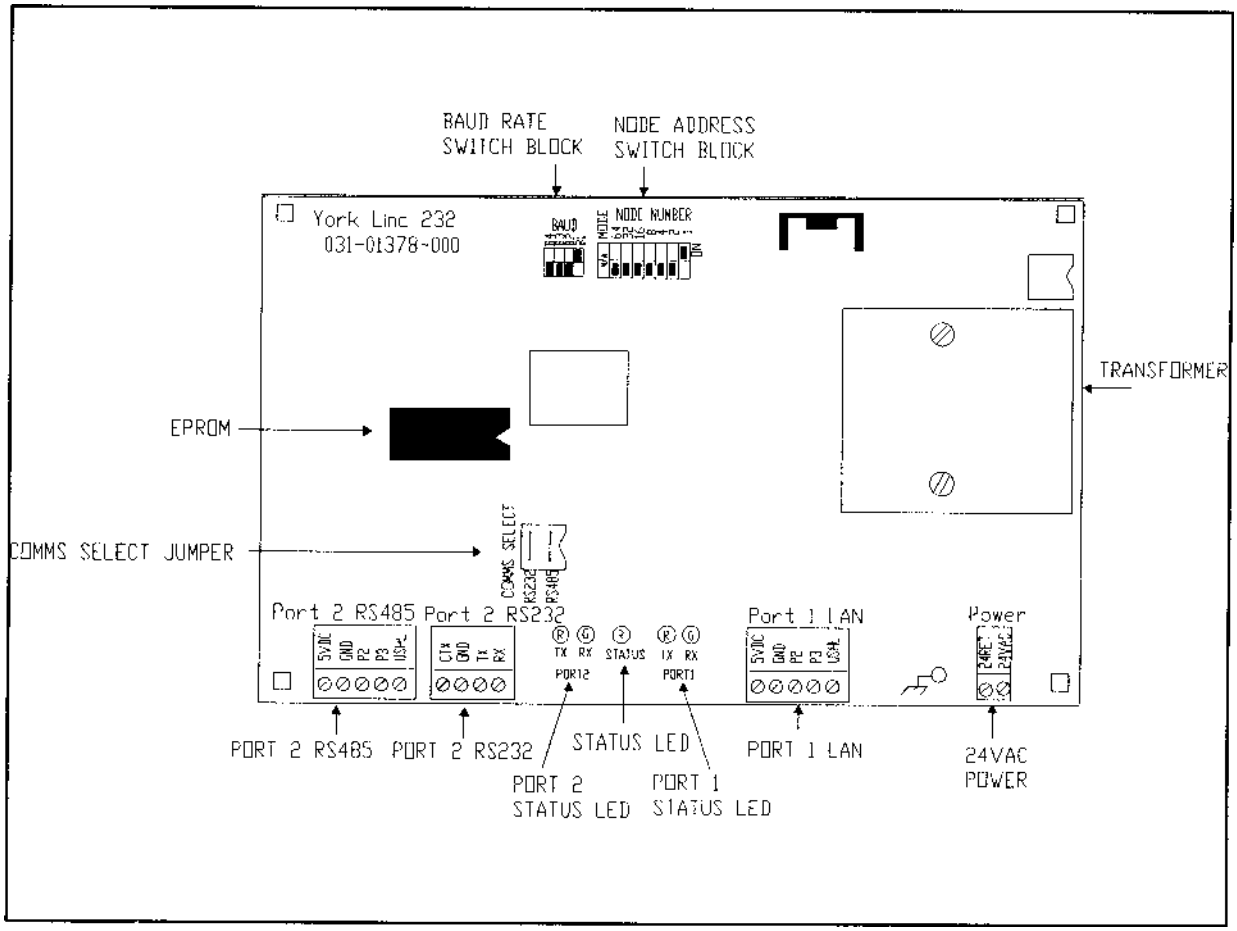
5. The LINC should now have power applied.

Wire Type

See the Standard Wiring Procedure Section later in the manual.

Processing Unit

LINC Component Layout



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Technical Specification for the LINC

Micro-Controller NEC V25 (8 MHZ)

PROM Memory

MAX PROM	256 Kilo Bytes
MIN PROM	128 Kilo Bytes

RAM Memory (Backed Up)

MAX RAM	128 Kilo Bytes
MIN RAM	32 Kilo Bytes

OPERATION OF THE LINC CARD

The LINC is the processing unit which uses the NEC V25 micro-controller operating at **8 MHZ** to run the application's and communication's software. The application's software resides within the **128 K bytes** of available backed up static RAM, while the operating system and support software reside within the **256 K Byte** of EPROM.

User Adjustable Parts

There are several operations which a User can perform on the LINC board. They are: upgrade the software, wire the power, wire the RS 232 port, the RS 485, and watchdog capability.

Changing the Software

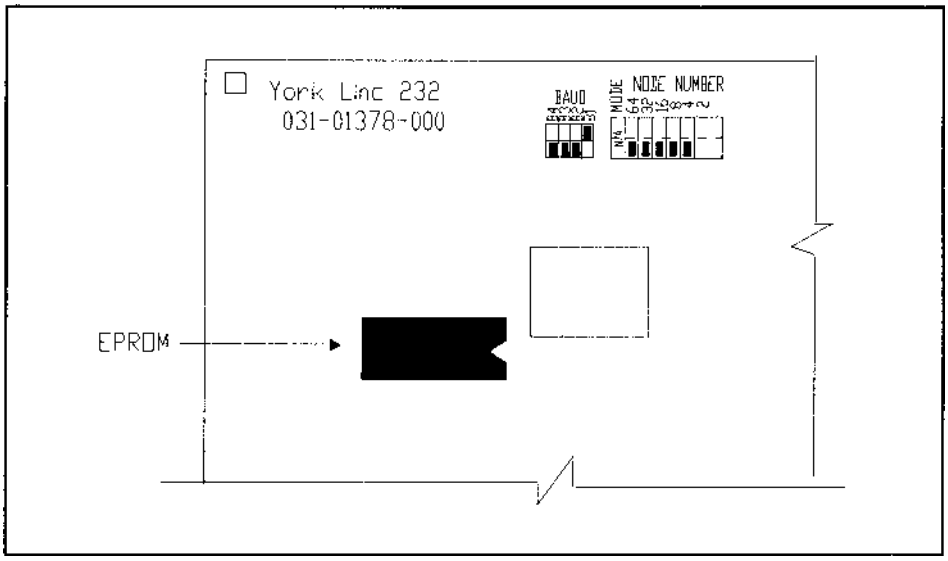
Periodically a new version of software becomes available. To benefit from any new features contained in this, the User will be required to upgrade the EPROM in the LINC. To accomplish this task the following procedure should be followed:

Note: Before attempting any work on the LINCs electronics, the User should take the appropriate anti-static precautions.

Changing the EPROM in the Linc

- Place your anti-static strap on your wrist, if none is available discharge yourself.
- The power to the LINC must be switched **OFF** before removing the EPROM.
- Using an EPROM extractor and remove the EPROM.
- Then insert the updated EPROM.
- Finally turn on power to the LINC.

(See diagram next page)



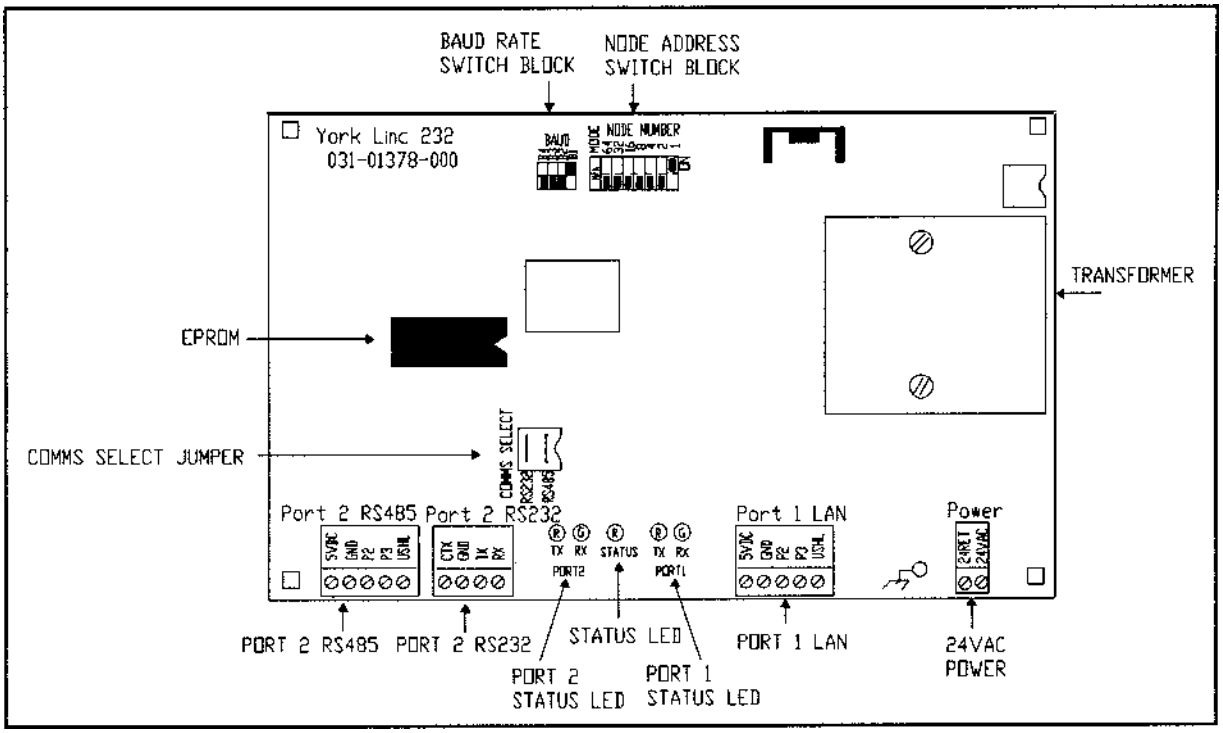
Changing the EPROMS in the Linc

Wiring

Wiring is discussed in the Power Connections section and Communications section.

Communications

Main Components of the LINC



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The LINC has two communication ports that are used on the Linc: Port 1 and Port 2.

Port 1 LAN PORT

Port 1 provides the LINC with a means of directly interfacing other controllers to the same Local Area Network. York's proprietary ISN network uses a twisted pair shielded cable to electrically connect all of the ISN devices together.

The network conforms to the electrical specification as dictated by the EIA RS 485 protocol. This defines the topology as being a multi drop radial, with the network being less than **4000 feet** in length and a maximum of **32 controllers** with both ends of the cable being terminated.

This port operates at **50K Baud** for normal LAN comms but can be software adjusted to different baud rates between **1200** and **9600** for York Talk applications.

Note: If the baud rate is changed from **50 K** baud, then the operation of the **Collision Avoidance Module** (CAM) will be disabled.

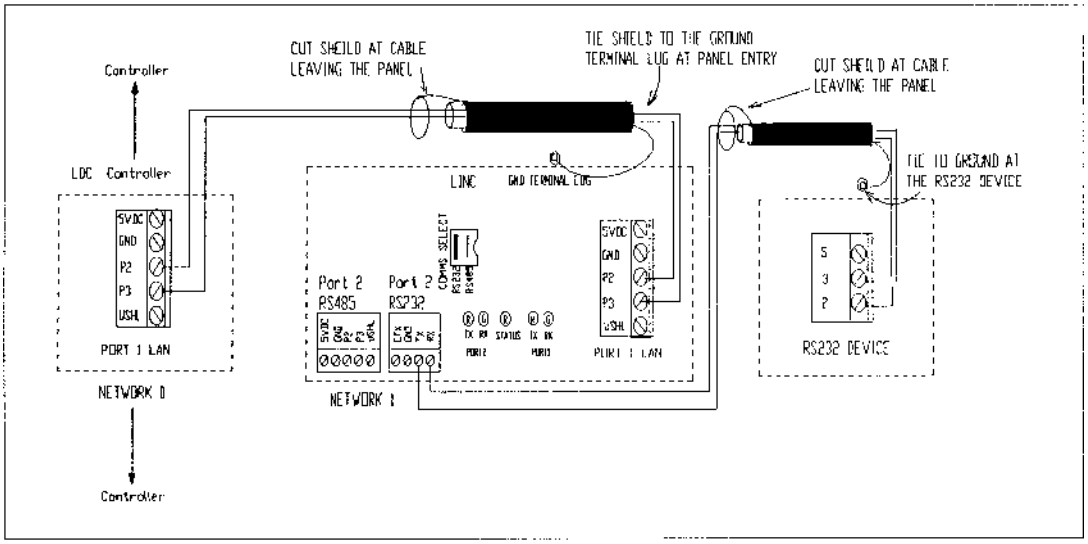
Connection to the Network

The LINC supports the connector which allows the User to connect the LINC controller onto the network. The LAN connector consists of a 5-way terminal block, ensuring that the installer doubles up on the number of cores which are installed per way. This arrangement is deliberate guaranteeing that if the LAN connector is removed from the controller the continuity of the network is not broken.

The LAN connector has been arranged to provide a connection to the following signals:

- **5VDC**
- **GND**
- **P2**
- **P3**
- **USHL**

Shield Wiring for the Linc Controller



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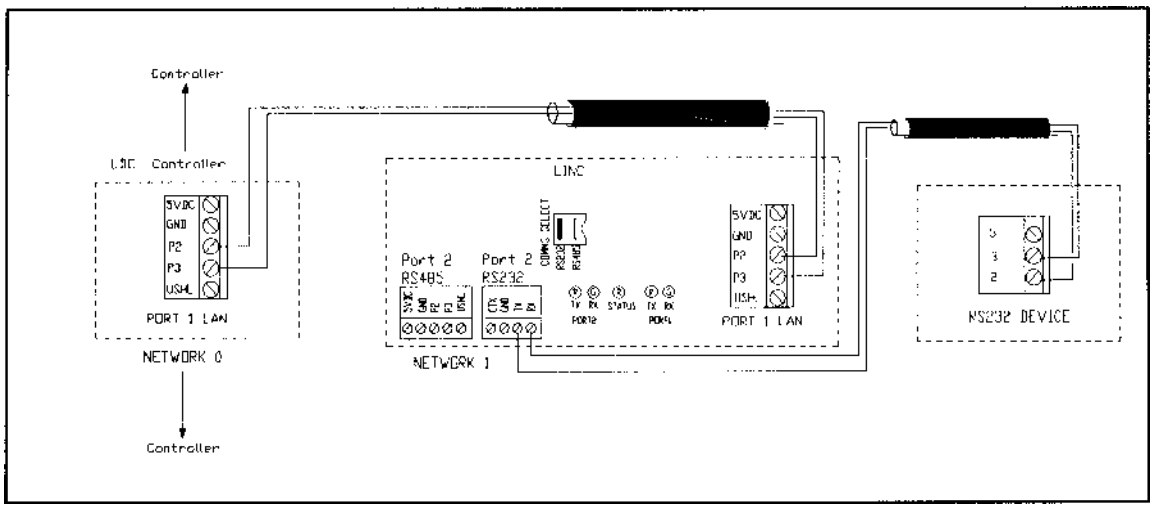
- The LAN cable screen must be connected to the GND terminal lug located at the panel entry point and cut the screen at the cable end leaving panel.

LAN Wiring for the LINC Controller



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- The **P3** & **P2** terminals are used to connect the RS 485 transceiver's signals to the network. The **P3** on one controller must be connected to the **P3** on the next controller in a daisy chain fashion.

Note: No End of Line Resistors are needed for the Linc.
Note: See diagram above for ground wiring.

Port 2 UNIVERSAL RS 232 (Port 2)

Port 2 provides the LINC with a means of directly communicating with other devices on a one to one basis.

This may be hardware configured as a standard RS 232 interface. This port is capable of transferring data at baud rates ranging from **1200 Baud** through to **9600 Baud**. Practically the RS 232 is accomplished by reversing the polarity in which a header is positioned in a socket.

Two separate connectors are provided, one to be used for connecting RS 232 devices, while the other is for the RS 485 York Network applications.

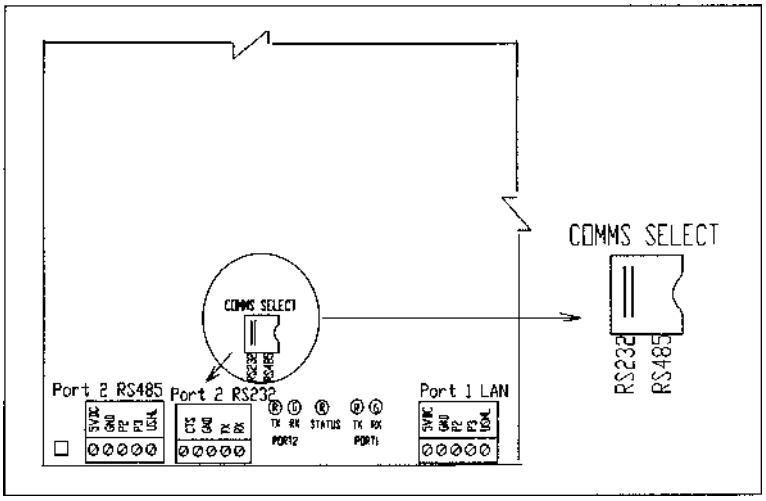
Port 2 RS 232 Connector

Definition	Function
Receive	RX 2
Transmit	TX 2
Ground	GND
Clear To Send	CTS

Port 2 RS 485 Connector

Definition	Function
Unconnected Shield	USHL
RS 485 Signal	P3
RS 485 Signal	P2
Ground	GND
5 Volts Power	5 VDC

To operate Port 2 as an **RS 232** interface, the comms selector must be in the position shown below. To establish RS 232 communications, remove the header block and position as shown.



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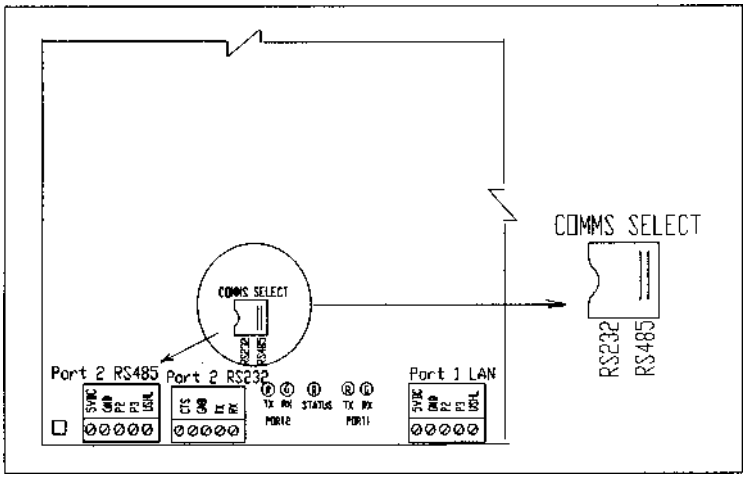
To operate Port 2 as a **RS 485** interface the comms selector must be in the position shown below. To establish RS 485 communications, remove the header block and position as shown.



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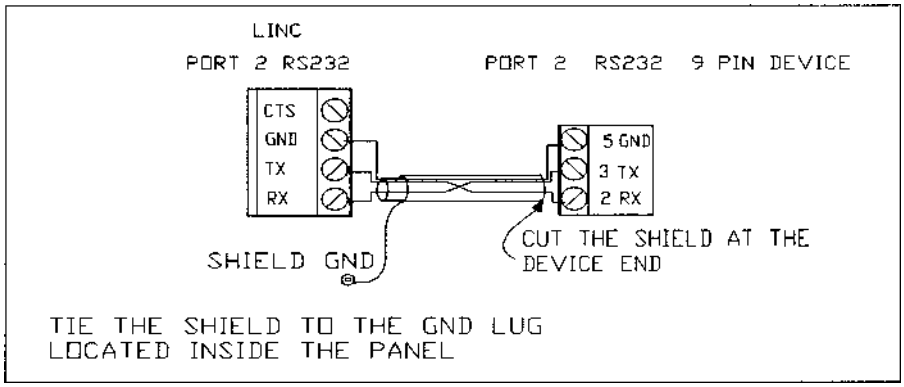
Communication Wiring Connections

Port 2 RS 232 to a 9-Pin RS 232 device



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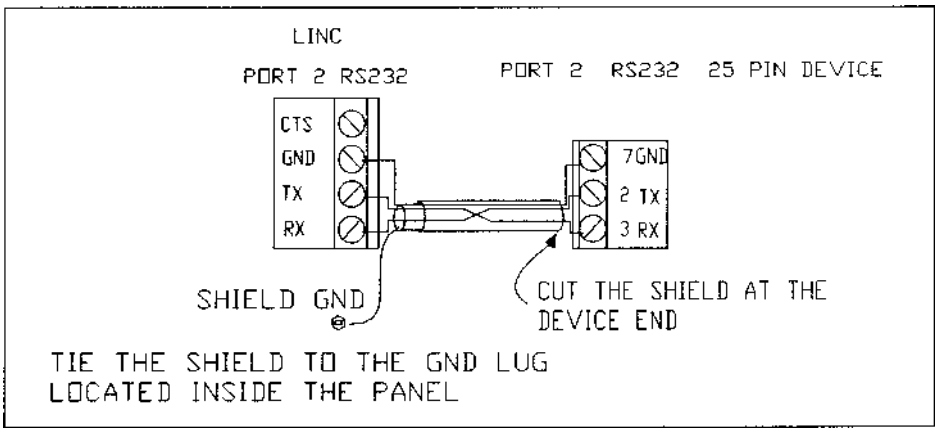
The connections for Port 2 to the RS 232 9-pin connector are wired as follows:

- Wire the LINC's **RX** terminal to **pin 3** of the RS 232 device.
- Wire the LINC's **TX** terminal to **pin 2** of the RS 232 device.
- Wire the LINC's **GND** terminal to **pin 5** of the RS 232 device.
- Wire the cable's shield to the **GND** terminal lug at panel entry point, and **cut the shield at the other end of cable leaving the panel**.

Port 2 RS 232 to a 25-Pin RS 232 device



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The connections for Port 2 to the RS 232 25-pin are wired as follows:

- Wire the LINC's **RX** terminal to **pin 2** of the RS 232 device.
- Wire the LINC's **TX** terminal to **pin 3** of the RS 232 device.
- Wire the LINC's **GND** terminal to **pin 7** of the RS 232 device.
- Wire the cable's shield to the **GND** terminal lug at panel entry point, and **cut the shield at the other end of cable leaving the panel**.

Auxiliary Devices

Watchdog Operation

Watchdog LOCATED ON THE LINC

The watchdog facility provides a means of resetting the processor on a system 'failure.' It is triggered by the failure of the software to refresh a re-triggerable timer. Visual indication of the system failure is provided by the status LED being extinguished. No external User connections are provided.

Note: The LINC only has one mode of watchdog operation, that being **Auto Restart.**

Auto Restart

In this mode the applications are restarted automatically.

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Switches & Indicators

The **LINC** contains five LEDS which collectively are responsible for indicating the operational status of the controller. The LEDS are used to display the status of the controller and the status of the three communication channels. The node switch which is used to set the unit's address is also located on the LINC.

The LEDS are located in different locations on the LINC. Refer to the LINC diagram in the Communications Section.

Status LED

The Status Led is used to annunciate the different operating states of the LINC. Each state is determined by the number of flashes within a predefined cycle.

The Status led has a flash rate of **0.25** seconds **ON** and **0.25** seconds **OFF.**

Controller Status. (Red Led)	**Function.**
Red Led ON	**The unit is operating correctly.**
Red Led OFF*	**The unit has malfunctioned, or there is no power applied.**
Red Led Flashing. (1 flash every 6 s)	**The unit is suffering with 'bad' comms on Port 1. The unit has a RAM failure.**
Red Led Flashing. (2 flashes every 6 s)	**Future Use**
Red Led Flashing. (3 flashes every 6 s)	**Node switch set to 0.**
Red Led Flashing. (4 flashes every 6 s)	**Future Use**
Red Led Flashing. (5 flashes every 6 s)	**Future Use**
Red Led Flashing. (6 flashes every 6 s)	**Future Use**

***** If the **LINC has malfunctioned** then the Status Led will flash once every **1.6 seconds.**

If the LINC is operating correctly with **no malfunctions** then the **STATUS led will** be **ON** continuously.

Communication Status LEDS

Two LEDS have been provided to indicate the operation of each of the communication ports. See table below.

i.	Port 1	**(Red & Green)**
ii.	Port 2	**(Red & Green)**

Port 1

Port 1 Status (Red & Green)	Function
Red Led ON	**Unit is transferring data out of Port 1 (TX)**
Green Led ON	**Unit is receiving data from Port 1 (RX)**

Red LED ON: This informs the User that the controller is transmitting data onto the LAN. This led will normally be OFF, pulsing ON when the unit is transferring data to another unit.

Green LED ON: This informs the User that the controller is receiving data from the LAN. As all the units on the network receive all the data that is being sent, this led will most likely be pulsing ON and OFF continuously, especially if the network is busy.

With no communications on the network, this led should be OFF. If, however, the led is ON continuously a network malfunction must be suspected.

Note: In **NORMAL** operation the Green led should flash each time data is received from the LAN, and each time data is transmitted out onto the LAN.

If the LAN's Green led is continuously **ON** / dimly lit, an abnormal condition exists. This may be caused by:

a. The LAN cable has been incorrectly terminated at the controller (i.e. P2 & P3 have been reversed).

b. The LAN has been incorrectly terminated (i.e. wrong termination resistors or an incorrect installation).

c. A high level of electrical noise coupling exists.

d. A defective LAN driver.

On a fully operational unit each time a unit transmits on the LAN, both its RED (TX) and GREEN (RX) leds must flash in unison.

Port 2

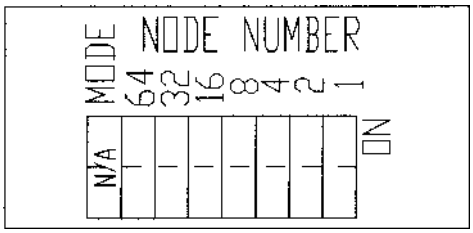
Port 2 Status (Red & Green)	Function
Red Led ON	Unit is transferring data out of Port 2
Green Led ON	Unit is receiving data from Port 2

Red LED ON: This informs the User that the controller is transmitting data out of Port 2. This led will normally be OFF, pulsing ON when the unit is sending data to the peripheral device connected to it.

Green LED ON: This informs the User that the controller is receiving data from Port 2. This led will normally be OFF, pulsing ON when the unit is receiving data from the peripheral device.

NODE SWITCH

The Node Switch provides the User with a means of uniquely addressing each LINC.



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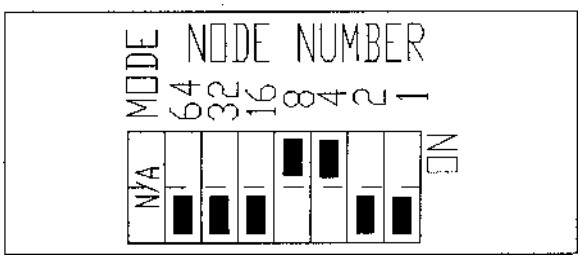
Node Switches allow the User to set the controller's node address.

Each of the switches are 'binary weighted': allowing any address from **1** through to **127** to be set.

An address greater than **99** may not be set on a LINC.

For example, an address of **12** would be selected by the following switch settings.



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Switches **8** and **4** are selected **ON**. All the rest are **OFF**.

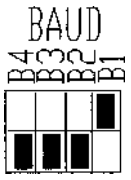
Switch h does NOT have any function in this product; it is not connected.

The **LINC** will **automatically reset itself** if it crashes The option for a manual reset does not exist.

BAUD RATE SWITCH

This switch is used to configure the operational Baud Rate of **Port 2**.

The Baud Rate of **Port 1** is **not configurable** and is **fixed at 50K**.



LD00636

LINC FM

The **Baud rate** of **Port 2 on this variant is fixed within the software at 9600 Baud;** therefore, the settings of the **switches are ignored.**

LINC PRINTER, LINC MODEM, LINC TERMINAL AND LINC MONITOR

The Baud Rate of **Port 2** on all of the above products is **adjustable by using the Baud rate switch**. The switch settings versus the baud rates are shown below:

Port 2 Baud Rate	B2	B1
1200	Off	Off
2400	Off	On
4800	On	Off
9600	On	On

LD00637

Baud Rate Adjustment

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Wiring

General Practices

All wiring should be carried out in a safe and neat manner and should **always** comply in all respects to the latest edition of any current State wiring regulation. The wiring should be installed in such a way that it does not prove to be a hazard and is protected against electrical and mechanical damage. Outdoor installations must all be in conduit or another approved installation material.

High / Low Voltage Separation

As a matter of good installation practice all '**low**' voltage wiring should be separated from '**high**' voltage carrying conductors. A minimum separation of **6 inches** is recommended to minimize any interaction.

When it is absolutely necessary to have '**low**' voltage wiring cross a '**high**' voltage carrying cable, then this should be done at right angles. In this context '**low**' voltage is any voltage less than **50 VAC**.

The operational integrity of the complete installation is very much dependant on the way in which the field wiring has been done. Short cuts may initially appear to be financially attractive; however, in the long run they usually prove to be more costly solutions.

Voltage & Thermistor Device Wiring

Wiring between sensors and the ISN EDC should ideally always be in one continuous length. This is a must for voltage and thermistor inputs and should be adhered to in all installations. Cable joints are prone to introducing resistive offsets which in the case of a voltage or thermistor sensor, will lead to errors. While these errors may be compensated for, they make future maintenance of the site more difficult.

Current Device Wiring

When using a current transducer, a spliced cable is more acceptable unless specifically precluded by a particular project specification.

Cable Types (screened versus un-screened)

With the exception of the following, screened cables should always be used:
Current devices, Power wiring, Wiring to ancillary devices, & Wiring to relay contacts.

Cable Specification Definitions

The descriptions below are provided to assist in understanding the specification of a cable.

The voltage rating of a cable is expressed as **Uo/U**.

Where **Uo** is the rms voltage between any insulated conductor and earth (i.e. the metal covering of the cable or the surrounding medium) and **U** is the rms voltage between any two phase of a multicore cable.

In this manual, stranded cables are designated by writing the number of strands followed by an oblique stroke, followed by a number, which represents the diameter of each individual strand.

For example, **(7/30)** refers to a cable which consists of 7 strands, each strand being AWG 30.

Use of Multicore Cables

Multicore cables are used as a means of reducing installation costs where a group of sensors/ actuators are located within one area.

Multicore cables come in many flavors, overall screened, individually screened pairs or no screening at all etc.

All **analog signals** with the exception of the ones using current must use individually screened pairs. **Digital** signals do not require the screening of individual pairs, however an overall screen does improve system reliability.

Note: Under no circumstances can power wiring be mixed with signal wiring in the same multicore.

Cable Insulation Rating

All insulation sheath materials must have a minimum temperature rating of **23 - 158 deg F.** All cable cores must be enclosed in a suitable insulation sheath e.g. Polyethylene. Cables carrying more than one core must also have an outer insulation sheath, normally PVC.

Types of Wiring

All the wiring **IN** and **OUT** of the ISN EDC Controller may be classified into categories depending on the specific application. The following applications are available:

- Power Feed
- Digital Outputs (FOM 1 Interface)
- Digital Outputs (FOM 2 Interface)
- Digital Inputs and Pulse Inputs
- Analog Inputs and Analog Outputs
- Communications
- Ancillary

Power Feed

All mains supply cables (that is cables carrying 120 VAC) should be installed in conduit trunking or a steel wired armored sheath.

The cable used should meet the following specifications:

Number Of Cores - 3
Conductor min Gage - AWG 18
Conductors - Plain Copper
Voltage Rating - (Uo/U) 300/600 V
Nominal current per core - 10 A

The earth conductor must as a minimum be the same size and have the same current carrying capacity as the **LIVE** and **NEUTRAL** conductors.

Aluminum wire is absolutely not acceptable for this application. Each power conductor must be identified with the appropriate color code.

- **BLACK** (Hot)
- **WHITE** (Neutral)
- **GREEN** (Earth)

Fusing

All mains supplied installations must be from a Fused Spur as defined in the Power connections section of this manual.

Digital Outputs (FOM 1 Interface)

A **FOM 1,** when configured to operate as a digital output, will provide a 24 volts DC signal which can be used to energize the coil of a relay either on a FOM 3 board or any other relay which has the correct coil characteristics.

Where several remote relays are located in one area, a multicore cable may be used to provide a more cost effective solution.

The cable used should meet the following specifications:

Number Of Cores - 2 or n if a multicore
Conductor Gage - AWG 22
Conductor Core Type - (7x30)
Conductors - Tinned Copper
Nominal Current Per Core - 1 A
Voltage Rating - 150 VRMS.

The maximum recommended length of cable to be used in this application is a function of line resistance and the Relay characteristics. The recommended maximum cable length is **300 Feet**.

Digital Outputs (FOM 2 Interface)

A **FOM 2** when used in the digital output mode provides a pair of change over contacts. The primary function of these contacts is to switch **24VAC**.

Like on the FOM 1 where several remote relays are located in one area, a multicore cable may be used to provide a more cost effective solution.

The cable used should meet the following specifications:

Number Of Cores - 2 or n if a multicore
Conductor Gage - AWG 18
Conductor Core Type - (16x30)
Conductors - Plain Copper
Nominal Current Per Core - 5 A
Voltage Rating 300 VRMS

The maximum recommended length of cable to be used in this application is a function of line resistance and the Relay characteristics. The recommended maximum cable length is **300 Feet**.

Digital Inputs

Digital Inputs rely on a voltage difference to determine an **ON** or an **OFF** state.

The Input circuit configuration for Digital and Analog is essentially the same and will require installation using the same cable specifications:

Number Of Cores - 2 or n if a multicore
Conductor Gage -AWG 22
Conductor Core Type - (7x30)
Conductors - Tinned Copper
Nominal Current Per Core - 2.5 A
Screen - Overall Beldfoil Shield
Capacitance between Conductors - Nom 80 pF/Meter
Voltage Rating - 300V

The recommended maximum cable length is **1000 Feet**.

IMPORTANT

The Installer must ensure that all Digital Input wiring is kept apart from any electrical power lines. Failure to comply may result in false state registration. A minimum of **6"** should be maintained between power and digital input wiring.

Analog Inputs, Pulse Inputs and Analog Outputs

Voltage, pulse and thermistor inputs, as well as voltaic analog outputs, must all use an approved screened cable and run in one continuous length between the ISN EDC and the sensor/actuator. If a current transducer is used, then the option of a non screened multicore cable may be taken. This is possible as current loops due to their low impedances are much less likely to be influenced by other signals in the vicinity.

When using voltage or thermistor inputs the screen must only be connected at one end, and that end should be within the ISN EDC enclosure.

Voltage, thermistor and analog outputs must all use a cable which meets the following specifications:

Number Of Cores - 2
Conductor Gage -AWG 22
Conductor Core Type - (7x30)
Conductors - Tinned Copper
Nominal Current Per Core - 2.5 A
Screen - Overall Beldfoil Shield
Capacitance between Conductors - Nom 80 pF/Meter
Voltage Rating - 300V

For voltage, thermistor, pulse and analog output applications the cable should have a maximum length of **1000 feet**.

Analog Inputs (current)

When current transducers are used the cable must meet the following specifications:

Number Of Cores - 2 or n if a multicore
Conductor Gage - AWG 22
Conductor Core Type - (7x30)
Conductors - Tinned Copper
Nominal Current Per Core - 1 A
Voltage Rating - 150 VRMS

Communications

Three types of cables are used, one for the local area network, one for York Talk network and the other for serial links to peripheral devices.

Local Area Network

The local area network interface is integral to each ISN EDC Controller. It consists of a connector into which the data communication cable is wired **IN** and **OUT** in a daisy chain fashion.

The data communications cable used must meet or better the following specifications:

Number Of Cores - 2
Conductor Gage - 24 AWG
Conductors - Tinned Annealed Copper
Conductor Core Type - (7x32)
Screen - Overall Beldfoil shield (100% coverage)
Characteristic impedance - 120 ohms
Mutual Capacitance - 12.8pf/feet or less
Core to Shield Capacitance - 23pf/feet or less
Nominal D.C.R. Conductor - 78.7ohms/Km

The York Talk network can be wired using the same cable as the LAN but is also capable of operating using a lower specification as described below:

Number Of Cores - 2
Conductor Gage - 20 AWG
Conductors - Tinned Annealed Copper
Conductor Core Type - (7x30)
Screen - Overall Braided shield (90% coverage)
Characteristic impedance - 78 ohms
Mutual Capacitance - 65pf/feet or less
Core to Shield Capacitance - 45pf/feet or less
Nominal D.C.R. Conductor - 34.6ohms/Km

Serial Links

The cables used for connecting peripheral communication devices to the ISN EDC shall be in one continuous length of no more than **50 feet**. The two serial links are served by one type of cable defined below.

Number Of Cores - 3
Conductor Gage - AWG 24
Conductor Core Type - (7x32)
Conductors - Tinned Copper
Screen - Overall Beldfoil Shield (100% coverage)
Mutual Capacitance - 30pf/feet or less
Core to Shield Capacitance - 55pf/feet or less

Ancillary

The cables used for interfacing ancillary equipment to the watchdog's and alarm volt free contacts may be the same as used for digital outputs (i.e. not screened).

Number Of Cores - 2 or n if a multicore
Conductor Gage - AWG 22
Conductor Core Type - (7x30)
Conductors - Tinned Copper
Nominal Current Per Core - 1 A
Voltage Rating - 150 VRMS

Recommended Cable Manufactures

The below cable types are given for reference

Manufacturer:	Part No:
Digital Outputs (FOM 1)	
Belden	8442 (Unscreened)
Digital Outputs (FOM 2)	
Belden	9156 (Unscreened)
Analog, Digital, Pulse Inputs and Analog Outputs	
Belden	8761 (Screened)
Analog Inputs (current)	
Belden	8442 (Unscreened)
Local Area Network (LAN)	
Belden	9841 (Screened)
York Talk Network (YTK)	
Belden	9272 or 9207 (Screened)
Serial RS232 Links	
Belden	9533 (Screened)
Ancillary Connections	
Belden	8442 (Unscreened)

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